

### REMARKS

The Office Action indicated that Claims 23 and 24 were allowed and that the subject matter of Claims 3 and 14 would be allowed if rewritten in independent form.

Accordingly, Claim 25 presents allowed subject matter indicated in dependent Claim 14, while Claim 26 represents the allowed subject matter of Claim 3.

The present invention is directed toward a cathode structure that can be utilized in an electronic gun of a very compact configuration wherein electron-emitting material can be efficiently heated. Our invention addresses problems associated with compacting the size of such cathode structures and avoiding the problem of condensation of electron-emitted material on the sides of the cathode structure that can eventually cause a short circuit between electrode leads of a heating wire and a metallic supporting structure.

As noted on Page 11 of our specification, we utilize a circular columnar ceramic body 16. The coiled portion of the heating wire is buried in the ceramic body. See Column 11, Lines 22-26. Lead parts of the heating wire extend out from an end surface of the ceramic body. An example of the dimensions of the ceramic body can be 1.5 mm in outside diameter and 0.5 mm in thickness. See Page 14, Lines 14-16.

In addition, as shown in Figures 2A-2D, the columnar ceramic body discloses a solid configuration. Further as described with regards to Figures 10A and 10B, alumina powder is placed into a mold and pressed so as to be "caked into a shape of the ceramic body 16." The caked alumina powder is then removed and sintered in a furnace to form a solid configuration.

The present invention, as defined in the amended claims, has a heater including a columnar electric insulating material body with a diameter larger than its height. The heating wire is partially buried and in contact with the electric insulating material body with the heating

wire coiled within the insulating material body. These features are now set forth in the previously rejected Claims 1, 5, 20 and 22.

With an electrical insulating material body that has a low columnar shape, we provide a heater that can be mounted in a compact configuration while heating an electron-emitting material in an efficient manner. Additionally, the issues of short circuiting can be lessened as a potential problem.

The Office Action rejected Claims 1, 2, 4-9, 11-13, 16, 18-20 and 22 as being unpatentable over *Yamamoto et al.* (U.S. Patent No. 6,300,711) in view of *Komiya et al.* (U.S. Patent No. 6,552,479).

The Office Action acknowledged that the *Yamamoto et al.* reference failed to teach an insulating material body with a heating wire coiled about a first axis parallel to a first end surface of an electric insulating material.

As can be seen in Figure 1, the *Yamamoto et al.* reference teaches a tubular sleeve 11 of a high melting point metal with a thin layer of a thermal absorption material applied to the inside surface of the tubular sleeve such as a black boride. More specifically, as taught in Column 3, Lines 7-11, a thermal absorption layer 12 of black boride should be within a range of 0.5  $\mu\text{m}$  to 10  $\mu\text{m}$ . The coil type heater 10 which is shown, but is not specifically described, appears to be offset on the central axis away from the outer tubular sleeve and not in contact with the thin layer of black boride.

The *Komiya et al.* reference also teaches an apparent cylindrical cathode support sleeve 28 with a heater 25 that is only fixed within the cathode support sleeve 28 by welding its leg portions to heater supports 24 as shown in Figure 8.

As noted in the Summary of the Invention in Column 3, Lines 56-63, the teachings to a person of ordinary skill in the art from the *Komiya et al.* reference, is that the tungsten wire used for the heater is very thin, that is between 30  $\mu\text{m}$  to 50  $\mu\text{m}$  in diameter and is, accordingly, very weak in mechanical strength, creating a significant problem in welding the heater to a heater support such as the brackets 24 in Figure 8. The manner in which this problem is solved is by providing multiple winding layers in the legs HT of a greater pitch number than that utilized in the actual heater portion, HD, shown in Figure 1.

This winding procedure can be seen in the respective Figures 2A-2I so that the winding pitch for the majority of the spiral winding in a single layer is smaller than the pitch of five winding layers in the respective leg portions, HT. Accordingly, the thickness of the leg portions should provide less electrical resistance and provide more and stronger material to enable the welding problem to be resolved.

Reference can be made to the graphs of Figures 3 and 4 which disclose the reductions of the resistance of the heater leg portions and the result in reduction of heater power consumption for a specific cathode temperature.

As noted in Column 8, Lines 15-22, the basic structure of the heater 25 of the *Komiya et al.* reference is similar to that of a conventional heater where the tungsten wire is spirally wound, subsequently coated with an alumina insulating film and then coated by prime tungsten powders to blacken the alumina film. There is no suggestion or teaching of a short and compact columnar electrical insulating material body of our present invention.

It is appreciated that the U.S. Patent Office tries to take the broadest possible reading of any claim language and was aware of the difference in problems and solutions offered by the

present invention over that of the prior art. The claims act as a lens in which to define the elements of the invention.

With the present amendments to the claims, it is believed that the cited references fail to disclose the features of the present invention and further, that the actual teaching of the *Komiya et al.* reference, when combined with the *Yamamoto et al.* reference, would suggest that the tubular sleeve of *Komiya et al.* could have a thermal absorption layer formed on its inside surface while the heater wire is subject to multiple windings at a shorter pitch in its leg sections in order to provide more mechanical strength and welding ability.

Neither of these references would teach the columnar electrical insulating material body of our present claims nor of the combination of features that permit not only a compact configuration with an enlarged heat transmitting capacity, but also reducing the possibility of short circuiting that can limit the life of the electron gun.

The Office Action finally cited *Lee* (U.S. Patent No. 5,451,831) in combination with the *Yamamoto et al.* and *Komiya et al.* references for rejecting Claims 10, 17 and 21. *Lee*, however, was only cited for teaching an electron-emitting material containing barium oxide and certainly does not address the other structural features of our heater. Accordingly, for the reasons mentioned above, these claims should also be allowable.

Often, it will be necessary . . . to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, this analysis should be made explicit.

*KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1740-41 (2007).

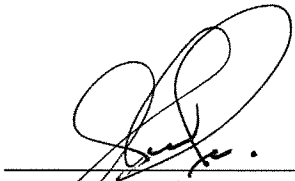
We believe that the currently amend claims have now resolved the rejection and the analysis required by the *KSR* case, in view of these claims, would not lead a person of ordinary skill to the solution of our present invention. Instead, a person of ordinary skill in the field lacking the guidance and template of our application would not, in combining these references, be capable of replicating the structure defined by our current claims.

In view of the above comments and the amendments to the claims, it is believed that the application is now in condition for allowance and an early notification of the same is requested.

If the Examiner believes that a telephone interview will help further the prosecution of this case, the undersigned attorney can be contacted at the listed telephone number.

Very truly yours,

**SNELL & WILMER L.L.P.**



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